Claims

1. A solid-state imaging apparatus comprising:

a light-receiving chip having a plurality of light-receiving cells arranged either one dimensionally or two dimensionally on one main surface of a base substrate; and

a transparent protection plate attached to the main surface of the base substrate to cover the light-receiving cells, a space being formed between the light-receiving cells and the transparent protection plate, wherein

an area of the transparent protection plate is equal to or smaller than an area of the light-receiving chip.

2. The solid-state imaging apparatus of Claim 1, wherein

the light-receiving chip further has:

a plurality of input/output lines provided on the main surface of the base substrate on which the light-receiving cells are arranged, the main surface being a first main surface;

a plurality of electrodes for connecting to outside devices, the electrodes being provided on a second main surface of the base substrate that is opposite to the first main surface; and

a plurality of conductive units insulated from each other, each conductive unit electrically connecting one of the input/output lines with a corresponding one of the electrodes.

3. The solid-state imaging apparatus of Claim 2, wherein

each of the conductive units is a through hole provided through the base substrate.

4. The solid-state imaging apparatus of Claim 3, wherein each of the electrodes is provided on an opening of a corresponding through hole on the second main surface.

5. The solid-state imaging apparatus of Claim 2, wherein each of the conductive units is a wiring formed on a side surface of the base substrate.

6. The solid-state imaging apparatus of Claim 1, wherein the light-receiving chip further has:

a plurality of input/output lines provided on the main surface of the base substrate on which the light-receiving cells are arranged, the main surface being a first main surface;

a plurality of electrodes for connecting to outside devices, the electrodes being formed on a second main surface of the base substrate that is opposite to the first main surface; and

a plurality of conductive units insulated from each other, each conductive unit electrically connecting one of the input/output lines with a corresponding one of the electrodes; and

a plurality of collective lenses provided on a light-receiving of the one main surface of the base substrate, wherein

the space is formed between the collective lenses and the transparent protection plate, and an index of refraction of the space is smaller than an index of refraction of the collective lenses.

7. The solid-state imaging apparatus of Claim 6, further comprising:

a sealing material operable to fix the base substrate and the transparent protection plate, wherein

the first main surface is made up of the light-receiving area on which the light-receiving cells are arranged and a periphery area surrounding the light-receiving area, the sealing material being provided on the periphery area, and

the space is sealed airtight by means of the base substrate, the transparent protection plate, and the sealing material.

8. The solid-state imaging apparatus of Claim 1, wherein

the main surface is made up of a light-receiving area on which the light-receiving cells are arranged and a periphery area surrounding the light-receiving area,

the transparent protection plate has a skirt portion at a periphery thereof, and

the skirt portion is attached onto the periphery area of the main surface, thereby sealing the light-receiving cells airtight and forming the space between the light-receiving cells and the transparent protection plate.

9. The solid-state imaging apparatus of Claim 8, wherein

the skirt portion is formed by plating metal on the periphery of the transparent protection plate that is a flat plate made of glass or resin.

10. The solid-state imaging apparatus of Claim 8, wherein

the transparent protection plate is a flat plate made of resin, and the skirt portion is formed by pressing the flat resin plate.

11. The solid-state imaging apparatus of Claim 1, wherein the main surface is made up of a light-receiving area on which the light-receiving cells are arranged and a periphery area surrounding the light-receiving area,

the light-receiving chip has, on the periphery area of the main surface, a rib portion having a loop shape,

the rib portion is attached onto a periphery of the transparent protection plate, thereby sealing the light-receiving cells airtight and forming the space between the light-receiving cells and the transparent protection plate.

12. The solid-state imaging apparatus of Claim 11, wherein the rib portion is an insulator made of a material for protective foil.

13. The solid-state imaging apparatus of Claim 1, being manufactured by attaching transparent protection plates onto a semiconductor wafer of light-receiving chips to generate an attached member in which the transparent protection plates are attached to the light-receiving chips respectively, and cutting the attached member into respective solid-state imaging apparatuses.

14. The solid-state imaging apparatus of Claim 13, being manufactured by simultaneously cutting out the light-receiving chip and the transparent protection plate, as a set.

15. The solid-state imaging apparatus of Claim 1, wherein

the main surface has a light-receiving area in a central portion thereof, and a plurality of electrodes outside the light-receiving area,

the transparent protection plate includes: a plurality of terminal pads formed on the other main surface that is different from the main surface; and a plurality of conductive members insulated from each other, each conductive member electrically connecting one of the electrodes with a corresponding one of the terminal pads.

16. The solid-state imaging apparatus of Claim 15, wherein a plurality of holes are provided through the transparent protection plate, the holes being provided in position that will not prevent light from traveling onto the light-receiving area, and part of each of the conductive members is positioned in a corresponding one of the holes.

17. The solid-state imaging apparatus of Claim 16, wherein the part of each of the conductive members that is positioned in the corresponding hole is a conductive foil attached to a side wall of the of the corresponding hole.

18. The solid-state imaging apparatus of Claim 16, wherein the part of each of the conductive members that is positioned in the corresponding hole is a conductive material filling the corresponding hole.

19. The solid-state imaging apparatus of Claim 15, wherein each of the conductive members is a conductive foil attached

to the main surface, a side surface, and the other main surface of the transparent protection plate.

20. A camera comprising a solid-state imaging apparatus of any of Claims 1, 2, 6, 8, 11, 13, and 15.

21. A camera comprising:

a solid-state imaging apparatus of Claim 1; and

a print wiring board having lands arranged to correspond, in position, to terminals of the solid-state imaging apparatus, wherein

each of the terminals is flip-chip mounted directly to a corresponding one of the lands.

22. A light-receiving chip comprising:

a plurality of light-receiving cells arranged either one dimensionally or two dimensionally on a first main surface of a base substrate;

a plurality of input/output lines provided on the first main surface of the base substrate;

a plurality of electrodes for connecting to outside devices, the electrodes being formed on a second main surface of the base substrate that is opposite to the first main surface; and

a plurality of conductive units insulated from each other, each conductive unit electrically connecting one of the input/output lines with a corresponding one of the electrodes.

23. The light-receiving chip of Claim 22, wherein

each of the conductive units is a through hole provided through

the base substrate.

24. The light-receiving chip of Claim 23, wherein

each of the electrodes is provided on an opening of a corresponding through hole on the second main surface.

25. The light-receiving chip of Claim 22, wherein

each of the conductive units is a wiring formed on a side surface of the base substrate.

26. A manufacturing method of solid-state imaging apparatuses each having: a light-receiving chip provided with a set of light-receiving cells arranged either one dimensionally or two dimensionally on one main surface of a base substrate; and a transparent protection plate, the manufacturing method comprising:

a protection-plate preparing step of preparing a plurality of transparent protection plates each having an area that is equal to or smaller than an area of the light-receiving chip;

an attaching step of attaching the prepared transparent protection plates onto a semiconductor wafer of light-receiving chips so that each set of light-receiving cells is covered by a corresponding one of the transparent protection plates, thereby generating an attached member in which the transparent protection plates are attached to the light-receiving chips; and

a cutting step of cutting the attached member generated in the attaching step into respective solid-state imaging apparatuses.

27. The manufacturing method of Claim 26, wherein

for one solid-state imaging apparatus, a corresponding main surface is made up of a light-receiving area on which a set of light-receiving cells are arranged and a periphery area surrounding the light-receiving area,

each of the transparent protection plates prepared in the protection-plate preparing step has a skirt portion at a periphery of the transparent protection plate, and

in the attaching step, a corresponding set of light-receiving cells of a solid-state imaging apparatus is sealed airtight by a skirt portion of a corresponding transparent protection plate that is attached onto a corresponding periphery area, so as to form a space between the set of light-receiving cells and the transparent protection plate.

28. The manufacturing method of Claim 27, wherein

each of the transparent protection plates is a flat plate made of glass or resin, and in the protection-plate preparing step, a corresponding skirt portion is created by plating metal on the periphery of each of the transparent protection plates.

29. The manufacturing method of Claim 27, wherein

each of the transparent protection plates is a flat plate made of resin, and in the protection-plate preparing step, a corresponding skirt portion is created by pressing the flat resin plate.

30. The manufacturing method of Claim 26, further comprising:

a wafer preparing step of preparing the semiconductor wafer of light-receiving chips, so that each light-receiving chip has a

rib portion in a loop shape, wherein

for each one solid-state imaging apparatus, a corresponding main surface is made up of a light-receiving area on which a set of light-receiving cells are arranged and a periphery area surrounding the light-receiving area, a rib portion being provided in the periphery area, and in the attaching step, the set of light-receiving cells is sealed airtight and a space is formed between the set of light-receiving cells and a corresponding transparent protection plate, as a result of a periphery of the transparent protection plate positioned on the rib portion.

31. The manufacturing method of Claim 30, wherein

in the wafer preparing step, a rib portion of a corresponding light-receiving chip is made of an insulative material that is the same as a material of a protection foil.

32. The manufacturing method of Claim 26, wherein

in the protection-plate preparing step, a sheet in which the plurality of transparent protection plates are linked together is prepared,

in the attaching step, the sheet of the transparent protection plates is attached onto the plurality of light-receiving chips in the state of the semiconductor wafer, and

in the cutting step, a light-receiving chip and a corresponding transparent protection plate is cut out as a set simultaneously.